

FIELD EVIDENCE FOR DISCRETE EPISODES OF INTRUSION DURING THE EMPLACEMENT OF THE LAND'S END PLUTON. RESULTS FROM DETAILED MAPPING AND OBSERVATION OF THE PORTH LEDDEN COASTAL SECTION



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INTRODUCTION

Part of the contact of the Land's End Granite pluton and the composite structure of the roof of the granite are continuously exposed along the foreshore at Porth Ledden and Lower Boswedden Cliff near St. Just on the Land's End peninsula. This exposure of the granite carapace lies immediately north of Cape Cornwall and the sections figured by Powell *et al.* (1999). The aim of this note is to present the results of detailed re-mapping of this area.

FIELD EVIDENCE

The details of the structure of the contact with the hornfelsed Mylor Slate Formation and of the separate intrusive stages which compose the roof of the granite have been mapped at 1:2500 scale using a corrected Ordnance Survey plan. This section is of particular interest because it lies in the domain of the St. Just wedge between the Zennor lobe to the north and the St. Buryan lobe to the south (Powell *et al.*, 1999). Some details and conclusions arising from the current study have already been published (Halls and Jinchu, 1997). The outer generation of the granite which forms the carapace is a megacryst-rich biotite granite which shows great variation in the textural organisation of the K-feldspar megacrysts. Mapping has shown that the geometry of the outer contact of the granite with the hornfelses is made up of sub-vertical NW to NNW trending segments governed by pre-granite fractures in the Mylor Slate Formation, combined with more gently pitched sections dipping northwesterly at about 30°. These segments of the contact are concordant with the dip of the axial planar cleavage of the recumbent folds in the metasedimentary rocks of the Mylor Slate Formation, the axes of which plunge gently to the north at 10-15°. The field evidence shows that the geometry of the Porth Ledden section of the Land's End Granite contact was formed in 'roof and gable' sections at the time of emplacement. Intrusion took place by a 'permissive' mechanism in which xenolithic masses were detached and sank into the rising magma. The detached xenolithic raft exposed in the central part of the Porth Ledden section and the invasion of the hornfelses by a vanguard of granite dykes demonstrate that stoping was an important mechanism, as described elsewhere by Bromley (1989).

The outer, older, megacryst-rich biotite granite shows textural and mineralogical variation suggesting that emplacement could have taken place in separate batches as thin sheets with some mixing between events. Mafic enclaves and small pelitic xenoliths are common in this outer carapace. This texturally complex envelope is intruded by a younger generation of tourmaline-rich granite which marks a chronologically separate episode in the construction of the Land's End pluton. The field relationships, as shown in Figure 1, demonstrate that the intrusion of this tourmaline granite must have taken place after the outer megacryst-rich generations had solidified. The internal granite contacts, like the outer contact with the Mylor Slate Formation,

are planar and show angular segmentation. Some segments of the two contacts are markedly parallel. This shows that the structural weaknesses in the rocks of the aureole were inherited by the solidified megacrystic granite carapace and subsequently exploited to enable permissive intrusion by stoping of large blocks of the megacrystic granite carapace into the later tourmaline granite. In apical irregularities along this inner contact, the borosilicate residuum from the tourmaline granite pooled and crystallised to form a durable quartz-tourmaline rock, locally with metre-scale miarolytic cavities containing coarse prismatic schorl and apatite. At the contact itself is a shell of quartz up to a metre thick, locally with pegmatitic facies. The phenomenon is akin to a 'stockscheider' and known in German literature describing analogous phenomena in the Erzgebirge as a 'quarzglocke' (see Charoy, 1979). Such a focus of borosilicate concentration gives some idea of the local anatomy of emanative centres in the Land's End Granite. The contacts between the quartz-tourmaline rock and the underlying tourmaline granite show fluidal and lobate geometry demonstrating that the two are co-existing facies of the same intrusive stage.

The mineralization of the Wheal Castle lode and the Praise lode resulted from reactivation of the sub-vertical fracture-controlled segments of the contact after consolidation of the outer part of the granite, however, the steps in the gable contact predate the reactivation of these structures to form fault-lodes. Productive parts of the lodes, marked by gunnises and shafts, may coincide with dilatant 'jogs' along these reactivated fractures.

CONCLUSIONS

The Porth Ledden section of the Land's End Granite provides an outstanding opportunity to study both igneous and hydrothermal relationships and some of the structural constraints which govern them. The conclusion from the field evidence is that this part of the granite was formed in two petrologically and chronologically separate cycles.

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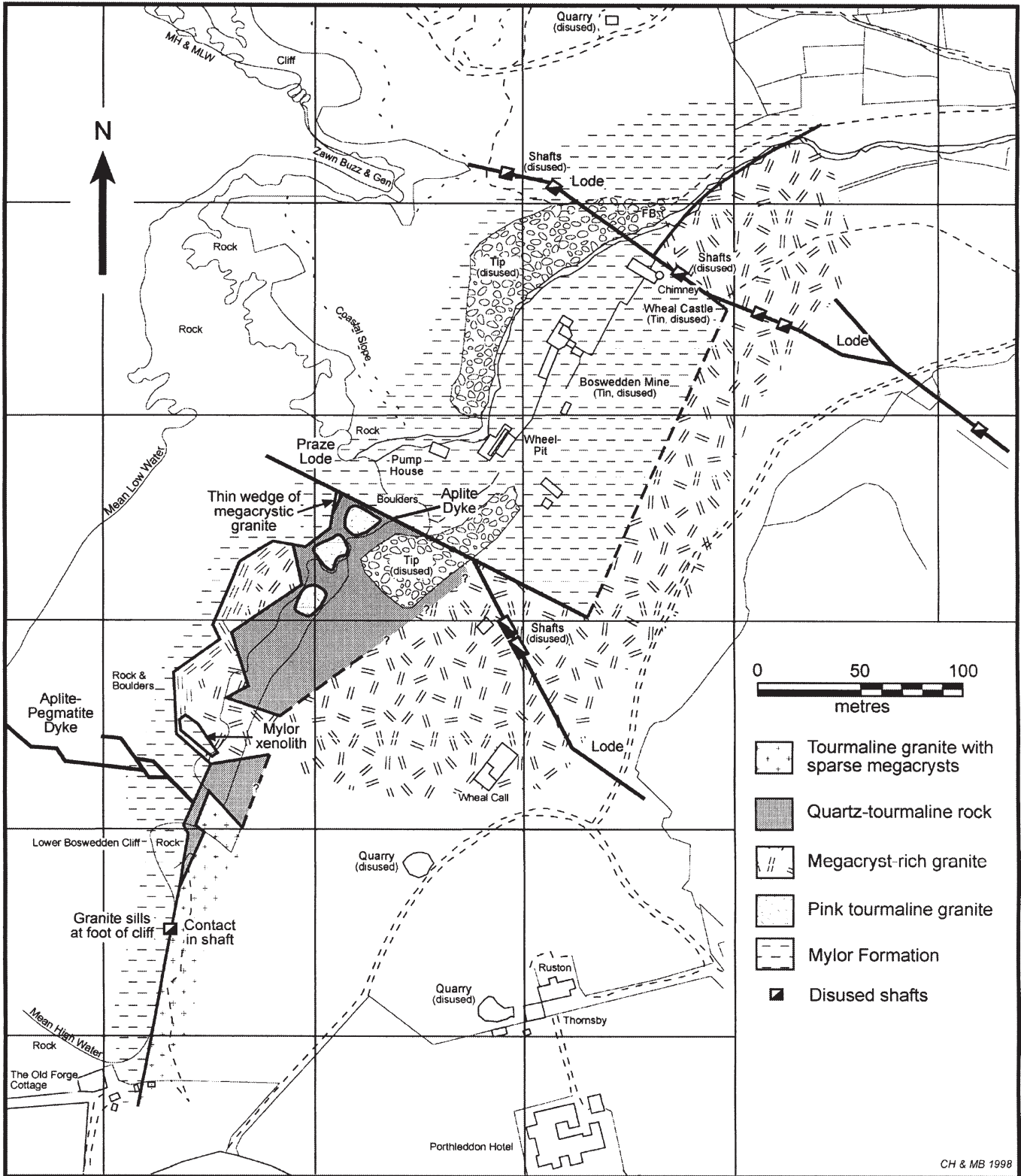


Figure 1. Geological map of the Porth Ledden coastal section.